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(White Book)

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**Defense Special Weapons Agency  
FY 1999  
Amended Budget Estimates**



# **Program Document**

## **Research, Development, Test and Evaluation, Defense-Wide**

(Supports Congressional Amended Budget Estimates)  
February 1998

**EXEMPTION STATEMENT A**  
Approved for public release  
Dissemination Unlimited

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**Budget Justification for Program Elements (PE)  
of the Defense Special Weapons Agency  
Research and Development Program**

**FY 1999 Amended Budget Estimates**

**February 1998**

**This document has been prepared to provide summary information on the Defense Special Weapons Agency, Research, Development, Test and Evaluation (RDT&E) Program. The R2 exhibits provide narrative information on all FY 1997 and FY 1998 non Special Access RDT&E Program Elements and projects.**

**The Quadrennial Defense Review (QDR) examined the national security threats, risks, and opportunities facing the United States out to 2015. Based on the QDR analysis, the Department of Defense designed a strategy for the New Century. The SecDef white papers, "Defense Reform Initiative(DRI)--The Business Strategy for Defense in the 21st Century" dated November 1997, announced a series of reforms necessary to carry out that defense strategy. Central to the reform effort is the reorganization of the Office of the Secretary of Defense (OSD) and the streamlining of the Defense Agencies. The DRI directed the establishment of the Defense Threat Reduction and Treaty Compliance Agency (DTR&TCA) to be formed by consolidating the Defense Special Weapons Agency (DSWA), On-Site Inspection Agency (OSIA), and the Defense Technology Security Administration (DTSA). In addition, several functions from the Office of the Secretary of Defense (OSD) and Washington Headquarters Services (WHS) currently involved in the management of associated programs will transfer to DTR&TCA as well. The DTR&TCA will also carry out programs to counter proliferation and reduce threats posed by weapons of mass destruction and provide nuclear weapon stockpile and related support. Effective 1 October 1998, the DSWA, OSIA, and DTSA components are disestablished and their mission, functions, and funding are transferred to the DTR&TCA. For FY 1999 and out, the DSWA budget submission reflects such disestablishment and transfer of resources to the DTR&TCA.**

DEFENSE SPECIAL WEAPONS AGENCY  
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE-WIDE  
R-1 LINE ITEM ORDER INDEX

<u>BUDGET ACTIVITY/ P.E. TITLE</u>	<u>P.E. NUMBER</u>	<u>R-1 LINE ITEM</u>	<u>PAGE NUMBER</u>
BA 2 Defense Special Weapons Agency	0602715H	2	1
BA 3 Verification Technology	0603711H	3	41

DEFENSE SPECIAL WEAPONS AGENCY  
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE-WIDE  
ALPHABETICAL INDEX

<u>P.E. TITLE</u>	<u>P.E. NUMBER</u>	<u>R-1 LINE ITEM</u>	<u>PAGE NUMBER</u>
Defense Special Weapons Agency	0602715H	2	1
Verification Technology Demonstration	0603711H	3	41

DEFENSE SPECIAL WEAPONS AGENCY

SPECIAL ACCESS PROGRAMS

Program Element/Project, Title

0602715H/AL, Classified Program

R-2 exhibits are not required for this project/program due to classification.

DEFENSE SPECIAL WEAPONS AGENCY  
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE-WIDE

BUDGET ACTIVITY  
(\$ in Thousands)

(THIS SUMMARY IS UNCLASSIFIED)

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
BA 2 Applied Research	189,224	203,706	0
BA 3 Advanced Technology Development	25,287	80,844	0
Total RDT&E Direct Reimbursements	214,511 3,878	284,550 12,600	0 0
Total Program	218,389	297,150	0

EXHIBIT R-1

DEFENSE SPECIAL WEAPONS AGENCY  
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE-WIDE

FYDP PROGRAM  
(\$ in Thousands)

(THIS SUMMARY IS UNCLASSIFIED)

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
0602715H Defense Special Weapons Agency	189,224	203,706	0
0603711H Verification Technology Demonstration	25,287	80,844	0
 Total RDT&E Direct Reimbursements	 214,511 3,878	 284,550 12,600	 0 0
 Total Program	 218,389	 297,150	 0

EXHIBIT R-1

DEFENSE SPECIAL WEAPONS AGENCY  
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE-WIDE

RESEARCH PROGRAMS  
(\$ in Thousands)

(THIS SUMMARY IS UNCLASSIFIED)

FY 1997      FY 1998      FY 1999

Defense Special Weapons Agency; PE #0602715H

6.2 Applied Research

189,224      203,706      0

Verification Technology Demonstration; PE #0603711H

6.3A Advanced Technology Development

25,287      80,844      0

Total RDT&E Direct  
Reimbursements

214,511      284,550      0  
3,878      12,600      0

Total Program

218,389      297,150      0

EXHIBIT R-1



Defense Special Weapons Agency  
Research and Development Project Listing  
FY 1999 Amended Budget Estimates  
February 1998

Program Element: #0602715H  
Title: Defense Special Weapons Agency

Budget Activity: Applied Research

(\$ in Thousands)	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003
President's Budget (2/97)	192,298	211,971	0	0	0	0	0
POM Submission	189,223	211,971	0	0	0	0	0
Current Budget Submission	189,224	203,706	0	0	0	0	0
<b>Project Title</b>							
AB Test & Simulation Technology	46,277	51,942	0	0	0	0	0
AC Weapon Systems Lethality	37,616	41,806	0	0	0	0	0
AE Weapon Safety & Operational Support	25,118	28,757	0	0	0	0	0
AF Weapon System Operability	40,501	43,873	0	0	0	0	0
AG Scientific Computations & Information Systems	17,075	19,213	0	0	0	0	0
AI Hard Target Tunnel Defeat and NTS Sustainment	5,145	10,708	0	0	0	0	0
AL Classified Program	2,994	2,407	0	0	0	0	0
AN Thermionics	3,000	0	0	0	0	0	0
AP Antiterrorism/Counterterrorism	2,498	0	0	0	0	0	0
AQ Deep Digger	2,000	0	0	0	0	0	0
AR Johnston Atoll Remediation	2,000	0	0	0	0	0	0
AY Bioenvironmental Hazards Research	5,000	5,000	0	0	0	0	0
<b>Total</b>	<b>189,224</b>	<b>203,706</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Defense Special Weapons Agency  
Research and Development Project Listing  
FY 1999 Amended Budget Estimates  
February 1998

Program Element: #0603711H		Budget Activity: Advanced Technology Development						
Title: Verification Technology Demonstration		FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003
(\$ in Thousands)								
President's Budget (2/97)		25,485	81,370	0	0	0	0	0
POM Submission		25,287	81,370	0	0	0	0	0
Current Budget Submission		25,287	80,844	0	0	0	0	0
Project	Title							
CA	Strategic Arms Control Technology	8,193	7,772	0	0	0	0	0
CB	Conventional Arms Control Technology	9,903	9,056	0	0	0	0	0
CC	Chemical Weapons Convention Technology	7,191	9,111	0	0	0	0	0
CD	Nuclear Arms Control Technology	0	54,905	0	0	0	0	0
Total		25,287	80,844	0	0	0	0	0

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998									
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE									
RDT&E, Defense-Wide/Applied Research - BA2		Defense Special Weapons Agency; 0602715H									
COST (In Millions)		FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Cost to Complete		
Total 0602715BR Cost		189.2	203.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Continuing
Project AB Test & Simulation Technology		46.3	51.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Continuing
Project AC Weapon Systems Lethality		37.6	41.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Continuing
Project AE Weapon Safety & Operational Support		25.1	28.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Continuing
Project AF Weapon System Operability		40.5	43.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Continuing
Project AG Scientific Computations & Information Systems		17.1	19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Continuing
Project AI Hard Target Tunnel Defeat and NTS Sustainment		5.1	10.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Continuing
Project AL Classified Program		3.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Continuing
Project AN Thermionics		3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Complete
Project AP Antiterrorism/Counterterrorism		2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Complete
Project AQ Deep Digger		2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Complete
Project AR Johnston Atoll Remediation		2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Complete
Project AY Bioenvironmental Hazards Research		5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Complete

#### A. Mission Description and Budget Item Justification

This program develops the technology base needed to support national security issues relevant to nuclear and other advanced weapons and force application technologies. Program initiatives include the development, upgrade, and maintenance of advanced nuclear weapons effects simulators to address weapon systems operability issues; conventional weapon targeting and strike planning tools for regional contingencies; battle damage prediction/assessment of conventional strikes against fixed hardened facilities; and predictive models for

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Applied Research - BA2	R-1 ITEM NOMENCLATURE Defense Special Weapons Agency; 0602715H	

Mission Description and Budget Item Justification (cont'd)

dispersion and transport of hazardous particles generated by attacks of Weapons of Mass Destruction (WMD) facilities. These projects also serve to support sustainment of a core nuclear competence in the national industrial base. Efforts encompass:

- Support for national security policy implementation.
- Support to CINCs in nuclear force structure, logistics, operations and stockpile programs.
- Quantitative assessments of nuclear weapons systems with development and maintenance of nuclear weapons system safety databases.
- Development, upgrade, and operation of simulators (radiation, blast, thermal, radio frequency propagation and optical/infrared background effects) to characterize operability of military systems during and after exposure to nuclear disturbed environments.
- Physical and functional characterization of hardened underground structure designs and associated vulnerabilities.
- Determination of nuclear and conventional weapons effectiveness against fixed targets. Emphasis is on targeting technical support, hard target kill criteria, and damage assessment methodologies.
- Utilization of weapons effects information to support development of adaptive targeting methodologies.
- Support of high-performance computing capability to maintain and upgrade the Agency's predictive codes in radiation hydrodynamics, structural dynamics, and electromagnetic propagation supporting nuclear and conventional weapon system lethality, operability, and safety assessments.

The 6.2 programs under this Program Element (0602715H) are divided into twelve projects. It should be noted that information concerning Project AL is classified per DoD Directive 0-5205.7, Para B.2.f.

The November 1997 Defense Reform Initiative (DRI) directed the establishment of a Defense Threat Reduction and Treaty Compliance Agency effective 1 October 1998. As a result of the DRI, resources for FY 1999 and out which were previously addressed in this PE have been transferred to PE 0602715BR (WMD Related Technologies).

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Applied Research - BA2		R-1 ITEM NOMENCLATURE Defense Special Weapons Agency; 0602715H

Project AB - Test & Simulation Technology - Development of effective, survivable, and affordable weapon systems requires a robust testing and simulation capability to support acquisition managers and decision makers. This project develops, provides and maintains unique DoD test and simulation facilities and enabling technologies that are used by the Defense Agencies, the Services and other federal agencies to evaluate the impact of hostile environments from conventional, nuclear and other special weapons on military or civilian systems and targets. These facilities provide blast, thermal, electromagnetic pulse, ionizing radiation and radio frequency propagation environments and testbeds to support DoD and national test requirements. This project leverages fifty years of testing expertise to investigate weapons effects and target response to a spectrum of hostile environments that could be created by proliferant nations or terrorist organizations with access to advanced conventional weapons or weapons of mass destruction (nuclear, biological and chemical).

The project includes the upgrade of existing simulators to extend their utility and life, the decommissioning of obsolete simulators, and the development of new simulators, when required, to compensate as much as possible for the lack of underground testing (UGT). Additionally, it provides the innovative, enabling technologies that make simulator enhancements and new facilities technically feasible and cost-effective. Specific programs in this project include: based on user test requirements, maintain two existing test centers - one at PRIMEX Physics International in San Leandro, California and one at Arnold Engineering Development Center (AEDC) in Tullahoma, Tennessee, including the development, construction and checkout of the new DECADE x-ray facility; development of technologies to provide enhanced radiation sources on the DECADE simulator; development of communications and radar propagation effects simulators, and infrared and optical scene generators; partnership with Sandia National Laboratories (DOE) to develop technologies in energy storage, power flow, plasma switches, debris shields, and radiation sources that are applicable to stockpile stewardship and DoD strategic systems sustainment; characterization, optimization and operation of the Large Blast/Thermal Simulator (LB/TS) at White Sands Missile Range (WSMR), including the demonstration of a non-ideal airblast simulation capability; operation and maintenance of the ARES electromagnetic pulse (EMP) facility at Kirtland AFB; and target defeat assessments for precision-guided and special weapons against Weapons of Mass Destruction (WMD) related targets.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Applied Research - BA2	R-1 ITEM NOMENCLATURE Defense Special Weapons Agency; 0602715H	

Project AB - Test & Simulation Technology (cont'd)

The project provides test beds for full- and sub-scale tests that focus on weapon-target interaction with fixed hardened facilities to include hardened aboveground bunkers, cut-and-cover facilities and deep underground tunnels. This effort supports the Services' requirements for hard target defeat testing and emphasizes teaming with the Services to assess weapon-target interaction of existing and developmental weapon systems. Specific activities include test bed design and construction, instrumentation and data collection, test coordination and execution, and post-test analysis and documentation.

This project relies on hardening and simulation technologies [Testable Hardware and Aboveground Testing(AGT)/UGT Correlation] funded under Project AF and supports the evaluation of weapons lethality accomplished in Projects AC and AI. Funded programs support JCS Joint Warfighting Capabilities: Control Space, Counterproliferation, Discriminate Attack, Global Reach and Situational Awareness, and also provide support to STRATCOM, EUCOM, USFK (PACOM) and ACOM.

FY 1997 Accomplishments

Test & Simulation (\$19,365K)

Reactivated the Magnetic Flyer Material response impact facility.

Completed Comprehensive AGT Radiation Test Center environment correlation.

Developed longer-area, debris-free cold test environment for weapon system material testing.

Completed development and demonstration of on-line remote simulator technology and support hardware to test customers' sites.

Continued operation of Tri-Service test facility; evaluated advanced thermal test needs/incorporated fidelity improvements.

Tested Navy ship decking and 1/4- scale masts, Air Force satellite antenna mast (SPACECOM), and an Israeli subscale structure.

Continued testing of vehicle types identified by the U.S. Army Nuclear and Chemical Agency.

Developed Non-Ideal Airblast (NIAB) simulation with LBTS.

Weapon/Target Interaction (\$5,810K)

Completed site survey, environmental assessment and design for tunnel defeat testbed.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Applied Research - BA2	R-1 ITEM NOMENCLATURE Defense Special Weapons Agency; 0602715H	

Project AB - Test & Simulation Technology (cont'd)

Supported test requirements by providing utilities and maintaining the construction capability infrastructure needed for the counterproliferation (CP), hard target defeat (HTD), and Hard and Deeply Buried Target (HDBT) programs.

Constructed industrial targets for the assessment of WMD Component damage, target response, and collateral effects for conventional weapons and enhanced payloads.

Radiation Simulators (\$21,102K)

Continued to develop signature requirements and munitions effectiveness assessment for hard target defeat.

Continued LB/Ts operation and maintenance; conducted blast/thermal operational testing.

Began DECADE Quad bremsstrahlung radiation source installation.

Demonstrated larger-area (ten times increase) debris shields and bremsstrahlung spectral diagnostics.

Optimized DECADE module large-area bremsstrahlung (LAB) performance.

Began R&D for high-fluence soft x-rays and high-dose and dose-rate bremsstrahlung sources on the DECADE Quad.

Installed low-voltage, warm x-ray source, fast-risetime hot x-ray source, and mixed gas cold x-ray source on Double EAGLE at PRIMEX Physics International, and developed gamma/beams capability for AEDC.

Began development of a portable, compact x-ray simulator for high-fidelity testing.

Continued to operate radiation simulators at PRIMEX Physics International and began a Modular Bremsstrahlung Source (MBS) operation at AEDC.

Closed Phoenix and Casino/Tactical Gamma Simulator (TAGS) at the Naval Surface Warfare Center; completed physical closure of Blackjack simulators.

Provided high explosive (HE) simulation infrastructure and test support, and maintained Permanent High Explosives Test Site (PHETS) facility at WSMR and Chestnut Site at Kirtland AFB.

Completed Radar Nuclear Effects Corruption and Simulator (RNECS) development and began initial operational tests; completed

Advanced Channel Simulator (ACS) development and began initial operational tests; evaluated advanced sensor focal planes in Nuclear IR Clutter Simulator (NICS); provided advanced SATCOM Simulation Test Support. Continued

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Project AB - Test & Simulation Technology (cont'd)

communication/radar atmospheric effects simulator participation in operability assessment/warfighting exercises, and evaluated Upgraded Early Warning Radar (UEWR) operability for National Missile Defense (NMD).  
Delivered Nuclear Optical Dynamic Display System (NODDS) chips to Navy for advanced radar and sensor fusion for Maverick missile evaluations.

FY 1998 Plans

Test & Simulation (\$19,902K)

Continue to provide HE simulation infrastructure and test support, and maintain PHETS facility at WSMR and Chestnut Site at Kirtland AFB.  
Complete RNECS development for Theater Missile Defense (TMD) and begin initial operational tests; complete ACS development and begin initial operational tests; evaluate advanced sensor focal planes in NICS; provide advanced SATCOM Simulation Test Support to assess TMD architecture communications link operability; continue communication/radar atmospheric effects simulator participation in operability assessment/warfighting exercises; and evaluate TMD Ground-Based Radar (GBR) operability.

Continue advanced SATCOM Simulation Test Support to MILSATCOM and Universal Modem.

Evaluate off-the-shelf technology for improvements in thermal and pressure diagnostics capabilities of LB/TS. Test three Navy ship deckings, one United Kingdom communications shelter and continue testing of Israeli subscale structure.

Weapon/Target Interaction (\$7,993K)

Awarded contract to develop and validate end-to-end targeting capability for conventional and nuclear weapons against tunnels. Continue to construct and rehab test target facilities, provide utilities, maintain the construction infrastructure, and execute tests needed for the CP, HTD, and HDBT programs. Complete tunnel testbed excavation.  
Continue to develop signature requirements and munitions effectiveness assessment for hard target defeat.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Applied Research - BA2	R-1 ITEM NOMENCLATURE Defense Special Weapons Agency; 0602715H	

Project AB - Test & Simulation Technology (cont'd)

Continue construction of industrial targets for the assessment of WMD Component damage, target response, and collateral effects for conventional weapons and enhanced payloads.

Radiation Simulators (\$24,047K)

Complete bremsstrahlung installation and begin optimizing the LAB DECADE Quad simulator.

Develop improved fidelity source for Nuclear Weapons Effects (NWE) testing on the DECADE simulator, plasma imaging and current diagnostics, and high-current, long-time implosion soft x-ray sources.

Improve radiation sources and instrumentation on the DECADE simulator.

Begin very large (500cm<sup>2</sup>) debris shield development for cold x-ray testing.

Continue to operate Double-EAGLE, Python, MBS, Decade Modules 1 and 2 (DM1/DM2) and ACE-4 simulators in support of customer testing and DECADE R&D.

Begin closure of the High Power Microwave Simulator and Fast Rise EMP Simulator.

Continue development of a portable, compact, high-fidelity x-ray simulator.

Continue advanced, high-fluence, soft x-ray and high-dose and dose-rate bremsstrahlung development for the DECADE Quad.

Develop interim, high-fluence, low-endpoint bremsstrahlung source for Double EAGLE for System-Generated

Electromagnetic Pulse (SGEMP) testing.

Develop high-dose capability to support testing of Strategic System Weapons.

Replace aging and obsolete instrumentation and diagnostics at test and R&D centers.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Applied Research - BA2	R-1 ITEM NOMENCLATURE Defense Special Weapons Agency: 0602715H	

Project AC - Weapons Systems Lethality - Building upon core Agency nuclear competencies in nuclear effects and target response, this project addresses the lethality of the full spectrum of weapons, including nuclear and advanced conventional weapons, against the target base of today and tomorrow -- ranging from ultra-hard underground facilities to above ground, unhardened surface facilities and other special facilities that may be associated with the production, storage or deployment of weapons of mass destruction. Helping to maintain the continued effectiveness of the nuclear deterrent, this project also seeks to provide decision makers and warfighters expanded conventional weapon options against well-protected, high-priority targets. The program relies extensively on advanced numerical methods, as well as laboratory scale experiments, intermediate and full-scale field tests and operational test data to quantify functional and physical damage criteria and collateral effects. Project results will be provided to operational planners through analytic prediction tools, multimedia hypertext databases, and technical manuals. Central to this support is an automated expert system to assist in pre-strike target planning and post-strike battle damage assessment. Technology developed in this project will also enable civil agencies to assess engineering designs to mitigate direct and collateral damage from terrorist attacks such as occurred at the Oklahoma City Federal Building and Khobar towers attack in Saudia Arabia. Additionally, the technology developed directly supports force protection issues, operations other than war and DoD support to civil authority.

On a broader scale, improvements in weapon effects and target response codes will be used to upgrade and expand physics-based modeling and simulation. These improved codes include: coupled finite difference-finite element codes, structure-medium interaction codes, groundshock propagation codes suitable for jointed and/or layered media and high resolution codes capable of predicting the transport of hazardous aerosol clouds over complex terrain. The understanding of weapon-target interaction resulting from this project will support the generation of weapon system requirements for the changing worldwide target base and provide a quantitative basis for planning contingency operations against high value targets. It will also improve the understanding of target/weapon interactions and their consequences for battle damage prediction and assessment. This project also includes the Electro-Thermal Chemical (ETC) gun advanced technology and projectile lifting body programs per Memorandum of Agreement (MOA) with the Navy; ETC gun technologies for the direct-fire applications, per MOA with the Army; and the development of high power electromagnetic source technology for warfighter applications.

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Project AC - Weapons Systems Lethality (cont'd)

Project AB, Test & Simulation Technology, provides the testbeds to support weapons lethality tests in this project. The computer tools and databases developed under this project support the execution of Project AI. This project supports the following JCS Joint Warfighting Capabilities: Counterproliferation, Discriminate Attack, Global Reach, and the Hard Target Defeat Program.

FY 1997 Accomplishments

Nuclear Weapons Effects Phenomenology (\$3,716K)

- Developed concepts for demonstrating nuclear weapons effects on underground storage facilities, other hard targets, and 14 additional very hard or very deep targets.
  - Developed non-ideal airblast phenomenology to support United States Army Nuclear Chemical Agency (USANCA) warfighting issues and to assist STRATCOM in target planning.
  - Developed a weapons output library to evaluate nuclear weapons effects from potential proliferants' weapons.
  - Completed energy coupling analysis for the W87 and W88 nuclear warheads.
  - Completed initial draft of radioactive output for non-US weapon output volume on tactical weapons.
- Application of Nuclear Weapons Expertise (\$15,354K)
- Developed a production capability to scale-up the manufacturing of high-energy-density dielectric materials for pulsed power applications.
  - Constructed brassboard pulse power supplies to drive the new high density capacitor.
  - Explored High Power Microwave (HPM) hardening technology for advanced applications; demonstrated effectiveness when applied to a commercial-off-the-shelf (COTS) computer.
  - Conducted demonstration of Electromagnetic (EM) effects on weapon system for one of our allies.
  - Completed long pulse megawatt class HPM power source.

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Project AC - Weapons Systems Lethality (cont'd)

Began definition of the vulnerability of nuclear reactors and nuclear reprocessing facilities to weapons effects.  
Developed a design module to evaluate the resistance of hardened structures to the effects of advanced conventional weapons.  
Validated predictive methods for advanced warheads and incorporated the results into the Munitions Effects Assessments (MEA) targeting tool.

Expanded MEA software to include additional fixed targets and weapons.  
Delivered advanced fluid/structural computational tools.

Weapon/Target Interaction (\$16,896K)

Developed fragility models for the components in high value fixed targets, including tunnels.  
Enhanced the MEA targeting methodology for the hard-to-defeat targets by including updated lethality models.  
Produced a final version of "Protective Structures Analysis and Design System" (PSADS), a portion of the Design and Analysis of Hardened Structures (DAHS) manual.

Began gun testing of composite projectile flight body components for ETC indirect fire.

Successfully fired steel projectile aft pin assembly and ignited rocket motor component post gun launch.

Completed advanced ETC indirect fire cartridge testing.

Began full-scale testing of ETC direct fire cartridges for the M256 main tank gun.

Initiated the UNIX version of the Hazard Prediction Assessment Capability (HPAC).

Expanded the Virtual Interactive Target (VIT) to include additional weapons and target types.

Provided weapon effects visualization capability to Counterproliferation Advanced Concept Technology Demonstration (CP ACTD).

Conducted initial hard target electrical effects test to evaluate functional defeat modes.

Procured specialized hardware/software for integration of weapons effects, structural response, nuclear phenomenology aides in DIS/High Level Architecture (HLA) environment.

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Project AC - Weapons Systems Lethality (cont'd)

US/Allied Survivability and Operability in Nuclear/Special Weapon Environments (\$520K)

Updated analysis tool for STRATCOM to assess aircraft survivability in dust environments along planned Single Integrated Operation Plan (SIOP) routes.

Test and Simulation (\$1,130K)

Initiated effort to remove the artificialities in pressure environments found for height-of-burst (HOB) weapons effects and implement in targeting tool for STRATCOM.

Developed geologic models needed for nuclear MEA targeting.

FY 1998 Plans

Nuclear Weapons Effects Phenomenology (\$6,674K)

Distribute interim Threat Vol 2 of Nuclear Weapons Manual & Output Handbook. Begin work on advanced nuclear threat volume.

Start development of computational capabilities to obtain 3-D radioactive output for strategic weapons.

Begin work on very hard target kill methodologies that will address multi-burst assessments of current weapons systems.

Complete the geological analysis of two additional foreign sites.

Finish material properties definition of a foreign target site.

Demonstrate prototype of nuclear MEA to NATO/SHAPE.

Perform nuclear terrorist incident analysis and consequence assessment.

Technical Information (\$1,528K)

Begin development of integrated CD ROM nuclear weapons effects computational aid.

Beta test and distribute battlefield nuclear targeting CD ROM.

Disseminate electronic version of Effects Manual-1 (EM-1) Technical Handbook.

Update chapters 2 & 3 of EM-1.

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Project AC - Weapons Systems Lethality (cont'd)

Application of Nuclear Weapons Expertise (\$16,346K)

Define the weapons effects vulnerability of nuclear reactors.

Construct breadboard of compact pulsed power sources.

Demonstrate HPM source effectiveness against multiple foreign assets in open field testing.

Develop HPM hardening technologies for Command and Control Warfare (C2W).

Begin to develop key technologies for advanced long pulse HPM solid-state sources.

Begin testing HPM hardening countermeasures on tactical systems.

Weapon/Target Interaction (\$15,706K)

Conduct HPM functional defeat experiments on C<sup>3</sup>I components.

Execute test program to define the vulnerability of components, subsystems and systems found in high-value fixed targets.

Develop fragility models for components found in high value fixed targets.

Begin work on Revision 1 of the DAHS manual that will include current research.

Develop vulnerability models for nuclear power plants attacked by advanced weapons.

Continue work on precision experiments for data gaps in DAHS methodologies.

Conduct full-scale testing of ETC direct fire cartridges for the XM291 main tank gun.

Continue scale test program to define penetration limits for advanced penetrators in rock.

Validate second generation weapon effects models used in MEA.

Complete gun testing of long-range composite projectile flight body.

Release a damage model for heavy water reactors attacked by conventional weapons.

Provide technical support and hardware/software to integrate weapons effects and target response codes into distributive environment.

Achieve 14 MJ in M256 tank gun using ETC 120mm cartridge.

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Project AC - Weapons Systems Lethality (cont'd)

Complete full steel projectile aeroshell gun testing.

Fire composite aeroshell with rocket motor to ballistic range of 25 nmi.

Conduct experimentation of ETC cartridge design for 17MJ performance level.

Complete investigation of new, more energetic material to achieve capacitor capabilities.

Complete construction and begin operation of charge development building at Green Farm.

Provide interactive synthetic targets for instrumented bombing ranges.

Continue advanced ETC direct fire and EM projectile testing.

US/Allied Survivability and Operability in Nuclear/Special Weapon Environments (\$370K)

Add graphics to analysis tools for STRATCOM to assess B-2 aircraft dust survivability for planned SIOP routes.

Test and Simulation (\$1,182K)

Extend initial nuclear MEA models to develop site and regional models for ground shock kill of ultra-hard targets.

Perform validation testing for particle formulation models for nuclear fallout prediction in urban areas.

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Project AE - Weapon Safety and Operational Support -This project is critical to the maintenance of a safe, secure and reliable nuclear deterrent, given that the enduring stockpile will retain weapons far beyond their designed life. Stockpile support efforts in this project include nuclear weapons stockpile technology for weapon system sustainment, probabilistic risk-based system safety assessments, and nuclear physical security policy/requirements validation. Reliability efforts include participation and assistance to Dual Revalidation, Annual Certification, and the Stockpile Stewardship Program. This project performs research and development in support of nuclear contingency planning, force structure deployment and employment options, innovative nuclear command and control concepts, nuclear mission planning, vulnerability assessments, safety assessments, advanced survivability concepts, and theater missile defense against Weapons of Mass Destruction (WMD) delivery systems and warheads. Vulnerability assessments of DoD and Allied fixed and mobile Command, Control and Communications (C3) assets subjected to WMD effects are also part of this project. This project includes the Modeling and Simulation Center, which provides integration of weapons effects, downwind hazard prediction models and force effectiveness models to users in acquisition, training, exercises, operations other than war, and warfighting. DSWA provides oversight, technical support and curriculum review for the Defense Nuclear Weapons School (DNWS) and other DoD nuclear training activities.

This project is in direct support of Presidential Decision Directives and taskings and requirements from OSD, the Joint Staff and CINCs. Relevant directives include National Security Strategy of Engagement and Enlargement, National Security Science and Technology Strategy, National Military Strategy, Joint Strategic Capabilities Plan, Presidential Decision Directives, Defense Planning Guidance, and prioritization memorandums from CINCs. These efforts have been closely coordinated with Joint Staff, OSD offices, CINCs and Services, Department of Energy, Federal Emergency Management Agency and the Federal Bureau of Investigation. The thrust of this project supports the JCS Joint Vision 2010 Warfighting Capabilities of Dominant Maneuver, Precision Engagement, and Full-Dimensional Protection.

FY 1997 Accomplishments

Nuclear Operations (\$15,530K)

Tested and computer-modeled pooled fuel fire heat fluxes and temperature distribution for B-52 fuel cell leak and storage building enclosing fuel leak.

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## Project AE - Weapon Safety and Operational Support (cont'd)

Prototyped and tested structural rebar tester to verify lightning protection system integrity for munition storage igloo.

Completed initial testing of prototype munitions storage igloo electrical/lightning sensitivity tester.

Initiated safety methods discussion with Russian counterparts.

Completed B-52H mock wing testing facility at national testing site for fuel fire mission.

Completed data collection and analysis for three of seven B-52H assessment phases.

Initiated safety assessment for fighter aircraft stationed in Europe.

Participated in the planning and initial execution of Dual Revalidation of the W76. Highlighted program and potential impacts to

DoD. Supported ATSD(NCB), Joint Staff, Services and STRATCOM in Annual Certification and other stockpile stewardship activities.

Developed a comprehensive collection of historical weapon development documents on CD-ROM for future reference during sustainment planning.

Performed an analysis of European area-wide Theater Missile Defense Command and Control requirements to support SHAPE.

Supported AFNORTH WMD deterrence requirements for force survivability, posture and employment options through analysis of Extended Air Defense requirements.

Delivered an editable, digital, artificial geographic database Synthetic Exercise Environment (SEE), with supporting forces, weather, and installation data for exercises and wargames involving the use of WMD.

Continued the initial development of an automated planning system for the airborne portion of the SIOP for STRATCOM.

Initiated a study towards the development of an interface between Air Vehicle Planning System (APS) and service planning systems such as Tactical Aircraft Mission Planning System (TAMPS), NATO Nuclear Planning System (NNPS), and

US/NATO intelligence systems.

Initiated an adaptive planning system software program to develop a deployable strategic planning capability for STRATCOM and initiate a modernized software interface between data collection sources and the Nuclear Planning and Execution System (NPES).

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## Project AE - Weapon Safety and Operational Support (cont'd)

Initiated the development of a replacement message/data handling spooler for the NPES. Cooperative effort with STRATCOM, JCS J38, and DISA.

Continued developing a prototype computer-based training capability for nuclear planning, emphasizing adaptive nuclear planning using NNPS parameters.

Continued the nuclear planning system target data feed which provides intelligence planning data in support of NATO nuclear planning.

Continued the development of a methodology for STRATCOM which includes the impact of fallout effects in achieving effective denial or delay of enemy access to key installations as a result of a nuclear strike.

Provided analytical support to assess STRATCOM capability to effectively meet national objectives involving the Single Integrated Operations Plan (SIOP) while reducing its complexity.

Utilized an analytical framework that facilitates WMD deterrence approaches to the needs of multi-regional scenarios.

Provided quick turn analysis on WMD consequence issues for OSD, Services and Joint Staff and provided weapons effects analysis to weapons Project Officer's Groups and weapons modification programs as requested.

Continued supporting system assessment and analytical weapons concepts as required; developed mission and consequence analysis for HQ Air Combat Command's (ACC) Agent Defeat Weapon phase studies and Analysis of Alternatives (AOA).

Education/Training to Maintain Core Competencies (\$1,269K)

Completed development of the Automated Nuclear Weapons Training System and transitioned it to DNEWS.

Continued development, improvement, and integration of course materials for the DNEWS.

Continued nuclear operational training support to CINCs, Services, and OSD.

Continued development of DoD general interest nuclear training program.

Continued support for DoD and CINC exercises and wargames with WMD/target response analysis and counterproliferation.

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## Project AE - Weapon Safety and Operational Support (cont'd) Modeling and Simulation (\$1,338K)

Achieved full operational capability of the DSWA Modeling and Simulation Center, including connectivity.

Provided technical support for exercises and war games.

Integrated WMD modules into campaign level analytical and assessment models to analyze effects of these weapons on campaign plans.

Initiated Analysis and Assessments Phase II contract to provide real-time support to Services through enhanced infrastructure, deployment teams, integrated models, and technical support.

Updated and refined support database per CINCs, Services, and Joint Staff guidance and continue development of consequence analysis of WMD counterproliferation programs.

Continued to develop Extended Air Defense Simulation (EADSIM) based scenarios for additional studies to support STRATCOM requests.

## Nuclear Weapons Effects Phenomenology (\$1,505K)

Provided an initial adaptive capability for 36-hour weather forecasts in support of operational exercises and test support, which will add to the effectiveness of WMD consequence predictions.

## US/Allied Survivability & Operability in Nuclear Designated Advanced Weapons Environments (\$5,476K)

Provided functional assessments of U.S. and foreign underground facilities identifying "Achilles' heels" for hard and mobile systems.

Assisted operational users in choosing investment strategies to mitigate and/or eliminate vulnerabilities.

Conducted Integrated Systems Assessments of selected national defense infrastructure facilities.

Continued Advanced Data Communications Survivability Program analyses and assessments.

Developed Prototype Survivability Planning System and planned follow-on Survivability Integration Demonstration Program.

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Project AE - Weapon Safety and Operational Support (cont'd)

FY 1998 Plans

Nuclear Operations (\$16,568K)

Complete the analysis of monomethylhydrazine (hypergolic) propellant for Minuteman III.

Complete the safety assessment of the B-52H aircraft.

Continue safety assessment for dual capable fighter aircraft to define operational risk management inputs and ensure USAFE nuclear capable weapon systems availability.

Provide safety assessment support to the NWC, ATSD(NCB), STRATCOM, Services, and Project Officer's Group.

Continue experimental testing to develop a technology base for fuel fire, energetic materials and electrical/lightning.

Complete the study on the development of an interface between APS and service planning systems such as TAMPs, NNPS, and US/NATO intelligence systems.

Initiate the development of the interface between APS and service planning systems such as TAMPs, NNPS, and US/NATO intelligence systems.

Continue an adaptive planning system software program to develop a deployable strategic planning capability for STRATCOM and initiate a modernized software interface between data collection sources and the NPES.

Complete the development of a replacement message/data handling spooler for the NPES. Cooperative effort with STRATCOM, JCS J38, and DISA.

Complete development of prototype computer-based training capability for nuclear staff planners, emphasizing adaptive nuclear planning.

Continue development of the nuclear planning system target data feed which provides intelligence planning data in support of NATO.

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Project AE - Weapon Safety and Operational Support (cont'd)

Complete the development of a methodology for STRATCOM which includes the impact of fallout effects in achieving effective denial or delay of enemy access to key installations as a result of a nuclear strike.

Continue to provide analytical support to assess STRATCOM's capability to effectively meet national objectives involving the SIOP while reducing its complexity.

Utilize an analytical framework that facilitates alternative WMD deterrence approaches to the needs of multi-regional scenarios. Conduct an annual force-on-force exercise to evaluate and validate policy standards as designated by the Security Policy Verification Committee (SPVC).

Continue to provide quick turn analysis on WMD consequence issues for OSD, Services, and Joint Staff and provide weapons effects analysis to Project Officer's Groups and weapons modifications program as required.

Begin development of an integrated reporting system for automated reporting of Nuclear, Biological and Chemical (NBC) activity and hazard predictions. Provide support to the CINC planning staffs on NBC capability and impacts on warfighting capability.

Develop mission and consequence analysis for HQ ACC's Agent Defeat Weapon phase studies and Analysis of Alternatives (AOAs).

Education/Training to Maintain Core Competencies (\$1,050K)

Provide nuclear operational training support to CINCs, Services, and OSD.

Continue development of general interest DoD nuclear training program.

Continue development, improvement, and integration of course materials for the DNEWS.

Support DoD and CINC exercises and wargames with WMD/target response analysis.

Nuclear Weapons Stockpile Management (\$600K)

In support of stockpile stewardship and reliability, continue DSWA participation in, and support to, the Dual Revalidation program with research, technical analysis, and assessment reports.

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Project AE - Weapon Safety and Operational Support (cont'd)

Provide technical support, progress reports and recommendations to ATSD(NCB), Joint Staff, Services, STRATCOM and other Combatant Commanders as required related to weapons safety, reliability and performance.

Provide support to the Annual Certification program and to the service weapons life-extension programs.

Develop a collection of historical development documents on CD-ROM related to sustainment of DoD nuclear weapon delivery platforms.

Modeling and Simulation (\$2,655K)

Increase DSWA Modeling and Simulation (M&S) Center capability with a broadband (DS-3) global networking circuit and an operational INTEL-S node.

Continue integration of WMD modules into campaign level analytical and assessment models.

Provide technical and operational consequence analysis support for exercises and wargames.

Continue Analysis and Assessments Phase II contract to provide real-time support to Services through enhanced infrastructure, deployment teams, integrated models, and technical support.

Update and refine support database per CINCs, Services and Joint Staff guidance and continue development of consequence analysis of WMD counterproliferation programs.

Continue development of EADSIM based scenarios for additional studies to support STRATCOM requests.

Integrate DSWA weapons effects codes into Common Operational Modeling, Planning and Simulation Strategy (COMPASS) program.

Publish classified and unclassified M&S Center web page.

Continue support of Director of Military Support (DOMS) and USMC/ Chemical Biological Incident Response Force with hazard prediction and consequence assessments regarding military/domestic threats involving WMD.

Nuclear Weapons Effects Phenomenology (\$1,433K)

Deliver an operational, automated, adaptive, user-friendly, high resolution 36 hour weather forecast capability to CINCs and Services.

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Project AE - Weapon Safety and Operational Support (cont'd)

US/Allied Survivability & Operability in Nuclear/Designated Advanced Weapons Environments (\$5,119K)

Deliver underground facility characterization and vulnerabilities guide to support CINCs and intelligence community in functionally defeating hard and deeply buried targets.

Conduct Balanced Survivability and Integrated Vulnerability Assessments as tasked by CINCs and DoD Agencies.

Develop and apply sensor technology for target characterization and battle damage assessments.

Weapon/Target Interaction (\$1,332K)

Integrate additional DSWA peculiar weapon effects and target response models into High Level Architecture (HLA) and CINC planning tools.

Integrate weapons effects and target response models in a live virtual and constructive environment which can be visualized for training, exercises and Bomb Damage Assessment using weapons effects Federates to satisfy customer requirements.

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Project AF - Weapon System Operability - Current and future warfighters and weapon systems, including the associated Command, Control, Communications, Computers and Intelligence (C4I) and support systems, must be able to tolerate and operate effectively through a spectrum of hostile battlefield environments. Planned efforts emphasize the development and demonstration of innovative and cost effective technologies to sustain the functional survivability of U.S. and Allied Forces and systems to advanced conventional weapons and limited nuclear attack. The military systems of interest include those that support warfighting missions in the air, on land, at sea, or in space.

This project constitutes the DoD's residual science and technology expertise in nuclear and related survivability matters. It develops and demonstrates affordable strategies and hardening technologies for U.S. systems; transfers the technical products to acquisition program offices; conducts component, subsystem, system and end-to-end performance tests and assessments as requested by the Services and CINCs; and provides support to the Office of the Secretary of Defense on technical and policy matters that relate to the acquisition of survivable systems and strategic system sustainment. Specific programs in the project include: development and demonstration of the enabling technologies for ensuring the continued availability of special materials and radiation tolerant microelectronics and photonic devices; development and demonstration of affordable hardening and mitigation methods that treat the adverse effects from electromagnetic, natural space and nuclear weapons engendered radiation (i.e., ionizing radiation and displacement damage), nuclear electromagnetic pulse, high power microwave and nuclear atmospheric environments; direct support to warfighters by predicting and quantifying the operational impact of nuclear, biological and chemical (NBC) and conventional battlefield environments on systems and personnel; development and demonstration of cost effective system design and test certification techniques for testable hardware that does not require underground nuclear tests; methods for measuring and increasing soldier effectiveness on NBC battlefields; performance and cost analysis to support the Defense Acquisition Board; and joint efforts with system program offices to apply the Agency's expertise and technologies to specific Service applications.

This project provides the testable system design rules and protocols for users of nuclear effects simulators that are funded in Project AB. It also supports the following JCS Joint Warfighting Capabilities: Information Superiority, Counterproliferation, Electronic Warfare, and Precision Force.

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Project AF - Weapon System Operability (cont'd)

FY 1997 Accomplishments

Nuclear Weapon Phenomenology (\$9,442K)

Continued development of Nuclear Weapons Effects (NWE) codes.  
Supported Space Based Infrared Satellite (SBIRS) sensors.  
Completed initial analyses of National Missile Defense (NMD) communication and radar functions in a nuclear environment.  
Delivered upgraded version of Strategic C4I Assessment Tools (STRATCAT) to USSTRATCOM.  
Continued developing Initial Space environment prediction Model (ISM).  
Developed equatorial inospheric clutter model for system analysis of new Over the Horizon Backscatter (OTH B) radar.  
Enhanced computer codes for predicting nuclear weapon effects on communication systems.  
Demonstrated human variability for radiation performance decrement.  
NWE Human Response Models and Simulations.  
Demonstrated human variability for radiation-induced and fire suppression-induced performance decrement in Modular

Semi-Automated Forces.

Demonstrated connectivity for infrastructure data exchange with the Intel Net.

US/Allied Survivability & Operability in Nuclear/Special Weapon Environments (\$18,720K)

Began testing of spacecraft, missile, and sensor demonstration test objects for validation of design and test protocols.  
Demonstrated software solutions to minimize radiation effects on system operability.  
Completed Aboveground Testing (AGT) and evaluation of materials for correlation with Underground Testing (UGT) data.  
Developed optical material test coupons to identify the relationship of design specification to material response for protocol development.  
Conducted combined effects testing of optical elements to resolve protocol issues.  
Completed commander's guidance for operations in low-level radiation environments.  
Evaluated the end-to-end operability of NMD architectures/elements in nuclear-disturbed environment.

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Project AF - Weapon System Operability (cont'd)

Evaluated the vulnerability of systems and C4I nodes exposed to a nuclear-disturbed environment.

Assessed/implemented innovative, low-cost Electromagnetic Pulse/High Power Microwave (EMP/HPM) hardening technology concepts for Service equipment survivability.

Continued assessment and testing of critical fixed-ground-based and mobile C4I facilities.

Developed PC-based Electromagnetic (EM) protection tool.

Delivered a regional version of the Consequence Assessment Tool Set to SOUTHCOM.

Radiation-Tolerant Microelectronics, Materials, and Electro-optics (\$12,339K)

Demonstrated, tested, evaluated, and qualified production-worthy, radiation-tolerant 1-megabit Complimentary Metal Oxide

Semiconductor/Silicon-on-Insulator (CMOS/SOI) and bulk Static Random Access Memory (SRAM) for U.S. Air Force Space and Missile Command (USAF/SMC) and BMDO.

Demonstrated, tested and evaluated radiation-tolerant SOI Bipolar Complementary Metal Oxide Semiconductor microelectronics for mixed signal applications in support of USN, USAF and BMDO requirements.

Demonstrated radiation-tolerant, low-power 200k gate array for USAF/SMC and BMDO use.

Demonstrated radiation tolerant, charge-coupled device (CCD) technology in support of USAF/SMC.

Completed development of the Microelectronic and Photonics Test Bed (MPTB) in preparation for the FY98 flight of the MPTB flight vehicle in support of USN, USAF and BMDO.

FY 1998 Plans

Nuclear Weapons Effects Phenomenology (\$11,214K)

Continue optical environmental support to SBIRS program.

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Project AF - Weapon System Operability (cont'd)

Complete enhancement of existing Nuclear Optical Radar Simulation Environment/Advanced Systems Survivability Integrated Simulation Tool Set (NORSE/ASSIST) and development of Nuclear Simulation (NUCSIM) NWE codes.

Perform SBIRS Low Earth Orbit (LEO) communication link evaluation.

Continue development of ISM.

Develop NWE model to perform analysis of HF/VHF systems.

Complete STRATCAT Version 2.0 for USSTRATCOM.

Review Russian EMP test data and development of a EMP Vulnerability Number (VN) product.

Enhance human response models - Consequence Assessment Tool Set (CATS) version 3.5, Joint Radiation Risk model and Fatigue Model.

Develop NWE Human Response Simulations, develop High Level Simulator (HLS) Chemical, Biological, Radiological (CBR) & FOX simulator.

US/Allied Survivability & Operability in Nuclear/Special Weapon Environments (\$18,079K)

Correlate material testing data to predict system-level performance.

Develop AGT/UGT threat correlation derived from the completed materials data sets.

Develop structural response data for missiles, penetration aids and reentry vehicles from UGT and data.

Upgrade testable hardware protocols based on validation testing of sensor subsystems in nuclear environments.

Finalize spacecraft missile design and test protocols.

Continue testing for validation of sensor design and test protocols.

Continue development and evaluation of low-level radiation standards and equipment for NATO review.

Complete evaluation of the end-to-end operability of NMD/Theater Missile Defense (TMD) architectures/elements in nuclear-disturbed environment.

Demonstrate Prototype Survivability Simulator Planning System in operational environment.

Initiate follow-on Survivability Integration Demonstration Program.

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Project AF - Weapon System Operability (cont'd)

Conduct SBIRS operability assessment, and evaluate the vulnerability of systems exposed to a nuclear-disturbed environment.  
Demonstrate affordable EMP/HPM design and test technologies, develop system hardening technology against advanced HPM techniques, and continue assessment and testing of critical fixed-ground-based C4I facilities.

Update High Altitude Electromagnetic Pulse (HEMP) protection/test standards.

Perform initial demonstration of radiation-tolerant, 16-megabit SRAM integrated circuit technology required by USAF and BMDO.

Radiation-Tolerant Microelectronics, Materials, and Electro-optics (\$14,580K)

Test and evaluate radiation-tolerant analog and digital microelectronics.

Demonstrate radiation-hardened 4M SRAM prototype.

Evaluate advanced photonics and compound semiconductor technology for DoD space-based applications.

Demonstrate radiation-tolerant, ultra-low-power SOI microelectronics technology in support of USN, USAF and BMDO requirements.

Conduct operability assessment of the Tactical Warning/Attack Assessments (TW/AA) System as it transitions to MILSTAR, SBIRS, and the Nuclear Detection System (NDS).

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Project AG—Scientific Computations & Information Systems. This project provides High Performance Computing (HPC), computational databases, information products, and advanced numerical models that enable the Agency's customers, researchers, and RDT&E contractors to answer questions about nuclear and advanced special weapons effects. Models, codes, and information products are developed to aid the design of experiments, predict types and levels of measurements required, establish system design requirements, assess performance, and provide system-specific predictions of weapons effects to DoD planners. Nuclear issues often require use of advanced computational resources, e.g., for investigation of the physics of weapon-target interactions, and for extrapolating test results into areas for which tests are no longer possible. This has required the Agency to develop a world-class high performance computing architecture with high bandwidth communications. This capability, currently with a hub at Los Alamos National Laboratory, is scheduled to transition to the new DoE and DoD HPC architecture over the FYDP. The Agency's Data Archival and Retrieval Enhancement (DARE) information system (a digital archive & retrieval system tailored to the specific needs of the researcher, the system designer, and developer) is supported by this project. This project funds the "graybeard" efforts for collection of unique and potentially perishable nuclear data with appropriate prioritization based on technical value. The principal thrusts respond to warfighter requirements for survivable systems and effective weapons in the Joint Warfighting Technology Areas of Discriminate Attack, Global Reach, and Counterproliferation.

#### FY 1997 Accomplishments

##### Nuclear Weapons Effects Phenomenology (\$5,973K)

Concluded development of DARE test data and waveform standards.

Provided scientific and technical information services and products as the DoD wide repository for test photos, films, data, test records and other information products.

Provided text to update Glasstone's book, The Effects of Nuclear Weapons, the standard reference for nuclear weapons effects.

Disseminated Science and Technology Digest.

Continued operation of web site providing radiation response of electronic parts.

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Project AG—Scientific Computations & Information Systems (cont'd)

Created Graybeard master plan to consolidate nuclear weapons effects test data, comment on data by original researchers, and prepare data for electronic archival in DARE.

Reviewed, approved, and archived perishable nuclear test data.

Infrastructure (\$6,159K)

Provided computer operations support through CRAY resources.

Provided continuous technical assistance for users of CRAY and other DoD HPC platforms and high performance networks to display supercomputer results.

Continued DATACOM computational support by providing annual support for Wide Area Network connection with additional T-1 backbone and high speed links.

Continued providing ongoing technical assistance and network management and conduct annual assessment of circuit utilization, price/performance, and requirements.

Completed acquisitions to create a scientific computing data center at the Agency and facilitate data researchers' access to DoD HPC modernization plan resources.

Completed initial phase of DSWA hubsite for enhanced connectivity to DoD HPC resources, and fully interconnect with the Defense Research and Engineering Network (DREN).

Provided broad-based science and technology Information Analysis Center research support.

Developed a nuclear targeting CD-ROM for battlefield.

Applications of Nuclear Weapons Expertise (\$2,429K)

Added original data to Nuclear Effects Data Management Assessment System.

Initiated development of computational aids for total characterization of nuclear weapons effects.

Initiated update of two more chapters of EM-1.

Began update process of the unclassified textbook entitled, The Effects of Nuclear Weapons.

Distributed the engineering handbook entitled, EM-1 Technical Handbook.

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Project AG—Scientific Computations & Information Systems (cont'd)

Developed integrated nuclear weapons effects computational aids.

Demonstrated the Agency's advanced numerical models at technical symposia.

Provided Advanced Computational Methods support by completing code work on explicit radiation modeling. Continued combustion/afterburning modeling for incendiary devices.

Data Archival and Retrieval Enhancement (DARE) (\$1,883K)

Expanded archival of airblast, thermal, and other nuclear test data, reports, and photography for population of DARE.

Continued development and testing of computational tools and system enhancements which provide greater search and analysis capability to the DARE customer.

Initiated development of video/text interrelationship with hyperlink capability.

Nuclear Weapons Technical Assistance Publications (\$444K)

Provided common administrative support (personnel, equipment, maintenance) for publication and distribution of the Agency's scientific and technical reports.

Weapon/Target Interaction (\$187K)

Benchmarked the Gudunov Adaptive Mesh Refinement (AMR) code with reactive burn model against precision experiments.

FY1998 Plans

Nuclear Weapons Effects Phenomenology (\$7,221K)

Complete master plan for ionization and EM effects areas of Graybeard knowledge capture program. Initiate archival of electronics/environmental interaction test data.

Provide scientific and technical information services and products as the DoD wide repository for test photos, films, data, test records and other information products.

Continue revision of Glasstone's book, The Effects of Nuclear Weapons, the standard reference for nuclear weapons effects.

Disseminate Science and Technology Digest.

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Project AG—Scientific Computations & Information Systems (cont'd)

Review, approve, and archive nuclear test data.

Continue operation of web site providing radiation response of electronic parts.

Host workshops on groundshock, thermal damage, structures damage to identify data locations, extent, and breakout of data commentary.

Complete compendium of nuclear weapon effect event objects.

Complete master plan for thermo structural data review/commentary/archival.

Complete master plan for biological data review/commentary/archival.

Infrastructure (\$7,398K)

Continue to provide computer operations support through centralized CRAY resources. Provide continuous technical assistance for users of CRAY and other DoD HPC platforms and high performance networks to supply display of supercomputer results.

Continue DATACOM computational support by providing annual support for Wide Area Network.

Continue to provide broad-based science and technology Information Analysis Center research support.

Continue computational support by providing annual support for the communication network and upgrade/acquire the network management equipment for the Agency hubsite.

Integrate DSWA's network with the DoD's HPC DREN network.

Applications of Nuclear Weapons Expertise (\$976K)

Provide Advanced Computational Methods support to the International Shockwave Congress and demonstrate DSWA's advanced modeling techniques.

Conclude development of integrated nuclear weapons effects computational aids.

Continue to develop and upgrade computational aids of nuclear weapons effects on various electronic media.

Disseminate individual nuclear weapons effects computational aids.

Conclude development and data inclusion to nuclear effects data management assessment system.

Provide Advanced Computational Methods support by validating code work on explicit radiation modeling.

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Project AG—Scientific Computations & Information Systems (cont'd)

Continue combustion/afterburning modeling for incendiary devices.

Validate advanced numerical models for complex flow/chemistry.

Perform a numerical study for the Advanced Radio Frequency Payload concept in support of DoD programs.

Provide Advanced Computational Support by hosting the International Shockwave Conference.

Data Archival and Retrieval Enhancement (DARE) (\$3,418K)

Expand archival of information and knowledge of nuclear weapons, other Weapons of Mass Destruction (WMD) and Agency mission areas for retrieval in DARE as outlined in DARE Master Plan.

Develop and test computational tools and system enhancements which provide greater search, retrieval, storage and analysis capability to the DARE customer.

Continue development of video/text interrelationship with hyperlink, and other innovative knowledge enhancement and preservation tools.

Weapon/Target Interaction (\$200K)

Add a reactive turbulent premixed combustion model to the AMR code and validate against precision experimental data.

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Project AI - Hard Target/Tunnel Defeat & Nevada Test Site (NTS) Sustainment

The United States and its allies face a growing threat related to critical military targets hidden within and shielded by hardened, deeply buried tunnel complexes which house battle management facilities, command, control, and communications facilities, theater ballistic missiles and their transporter-erector-launchers (TELs), and biological/chemical/nuclear weapons production or storage facilities. An objective of this program is to examine the existing U.S. and Allied capabilities to hold hardened, deeply buried tunnel targets at risk, thereby defining a current performance baseline. Any deficiencies will be identified and the ability of planned systems to address these deficiencies will be assessed. Finally, new technologies needed to mitigate remaining shortfalls will be evaluated as candidates for new hard target defeat acquisitions. Activities respond to priorities by the Office of the Under Secretary of Defense for Acquisition and Technology (OUSD(A&T)), Hard and Deeply Buried Target Defeat Capability Initiative and warfighting CINCs. Efforts in this program provide part of the technology base needed for counterproliferation activities conducted in other DoD programs.

The Presidential Decision Directive (PDD) on Stockpile Stewardship implemented an indefinite moratorium on underground nuclear testing while requiring retention of the capability to resume testing at Presidential direction. DSWA has complied with this policy by realigning the previously existing underground test program to emphasize non-nuclear weapons test technology and facility development, and to conduct a program for an orderly decommissioning and mothballing of the national underground nuclear test assets. The following major tasks will satisfy this requirement: (1) continue test complex shutdown, and tunnel stabilization and preservation; (2) continue environmental characterization; (3) document testbed design and construction methodology; (4) maintain UGT readiness through joint test organization activities at NTS including counterproliferation and hard target defeat testing; and (5) support SOCOM efforts to develop tactics and techniques for JCS Joint Warfighter Capabilities of Discriminate Attack and Counterproliferation. Project AI is linked to Project AB, through which its testing is conducted, and to Project AC which leverages its weapons work.

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Project AI - Hard Target/Tunnel Defeat & Nevada Test Site (NTS) Sustainment (cont'd)

FY 1997 Accomplishments

Weapon /Target Interaction (\$1,955K)

- Completed data survey and geologic characterization of Korean Multiple Rocket Launcher (MRL) sites.
- Continued support for USD(A&T)'s Hard and Deeply Buried Target Defeat Capability program.
- Completed lab-scale portal damage tests on intact rock.

Bomb Damage Assessment (\$500K)

- Developed an automated weaponeering tool for portal and tunnel damage (based on tunnel portal test data).
- Continued compiling a database of Balanced Survivability Assessments and began applying the data to the problem of identifying vulnerable nodes in underground facilities.

Test and Simulation (\$2,690K)

- Maintained Agency activities at NTS in support of environmental remediation activities.
- Provided on-site personnel to plan and supervise environmental remediation of Agency facilities.
- Maintained one tunnel complex in support of the stockpile stewardship program.
- Completed lab-scale penetration tests on intact rock in support of phenomenology/validation tests.
- Completed tests on unlined and lined tunnels in Norway geology.
- Evaluated weapon/target interactions for new weapons concepts, enhanced payloads, and target fragility.
- Continued test sequence for hard target kill and functional vulnerability of hard tunnel facilities.
- Continued supporting SOCOM training and tactics development by providing targets, equipment and personnel.

FY 1998 Plans

Weapon/Target Interaction (\$3,989K)

- Develop geoeengineering models describing key aspects of geology pertaining to warhead penetration and damage propagation.

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Project AI - Hard Target/Tunnel Defeat & Nevada Test Site (NTS) Sustainment (cont'd)

- Enhance the MEA tunnel module by adding subroutines for improved target geology, penetration models, and subsystem damage.
- Continue support for USD(A&T)'s Hard and Deeply Buried Target Defeat Capability program.
- Evaluate weapon/target interactions for new weapons concepts, enhanced payloads, and target fragility.
- Continue field tests on blast/fragmentation/fire damage to target subsystems, including blast doors, vehicles, and equipment.
- Collect and evaluate target and event signatures for surveillance.
- Bomb Damage Assessment (\$500K)
  - Complete the automated engineering tool to identify and exploit vulnerable nodes in underground facilities.
  - Begin evaluation of target reconstitution, post-attack.
- Test and Simulation (\$6,219K)
  - Maintain Agency activities at NTS in support of environmental remediation activities.
  - Provide on-site personnel to evaluate environmental remediation requirements of Agency facilities.
  - Maintain one tunnel complex in support of the stockpile stewardship program.
  - Conduct tunnel construction/test support exercises.
  - Perform tests and demonstration for functional kill of operational hard tunnel facilities.
  - Continue test sequence for hard target kill and functional vulnerability of hard tunnel facilities.
  - Begin construction of a missile tunnel facility test tunnel.
  - Undertake site characterization and relative risk evaluation (drilling, sampling, and analysis) for the Area 12 Drillholes, Rainier Mesa Mudpits at T-, N-, and E-Tunnels, and N-Tunnel Drums site.

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Project AN - Thermionics - Meeting national objectives in both the military and civilian areas will require large capacity (40-100kW) nuclear space power systems having long lifetimes. Potential applications have been identified by the Air Force and NASA. The Air Force "New World Vistas" study, dated 15 December 1995, cites specific requirements for space nuclear power to accomplish force projection from space. NASA has identified requirements for power and propulsion for contemplated deep space missions and manned exploration. The objectives of the Advanced Thermionics Program are to advance the state of the art of thermionic power conversion in the United States, to develop high performance and highly reliable thermionic converters that provide high output power per unit of system mass, to demonstrate the capabilities of these thermionic converters, to show their feasibility for use in thermionic systems, and to develop corresponding system level conceptual designs. This effort supports the Defense Technology Area Plan for Space Platforms.

FY 1997 Accomplishments

In-core thermionic development (\$1,800K)

Awarded contract to design, fabricate, and (non-nuclear) test high-performance and high-reliability converters for in-core thermionic fuel elements. Completed initial models of 100 kilowatt power system and corresponding converter.

Microminiature Thermionic Converters (MTCs) (\$1,200K)

Successfully applied trial tricarbonates on the emitter portion of the converters, and initiated work on scandate coatings. Completed conceptual designs of individual MTC cells and of ten-cell modules with both series and parallel circuits.

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Project AP - Antiterrorism/Counterrorism - This project was created to accommodate an FY 97 Congressional add under the FY 1997 Antiterrorism Budget Amendment. The funds were provided for the purpose of applying Agency expertise in physical security of nuclear weapons and vulnerability assessments to parallel physical security and facility vulnerability issues in the antiterrorism arena. The efforts were focused to enhance the security of U.S. forces and assets by identifying vulnerabilities and potential mitigation techniques and support.

FY 1997 Accomplishments (\$2,498K)

- Adapted hardened underground facility vulnerability assessment methodology to apply in assessing facility vulnerabilities to devices likely to be employed by terrorists.
- Conducted representative assessments to demonstrate and validate methodology.
- Transitioned methodology and provided support to DoD personnel in achieving assessment capability.
- Provided technical support to define and implement antiterrorism-related aspects of exercise planning and execution.

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Project AQ - Deep Digger - This project proposes to develop a "Deep Digger" design for attacking hard targets such as leadership or C3 Bunkers, underground factories, or weapon storage facilities. The U.S. Services have identified a need to defeat such hard and buried targets. Current weapons have only limited capability against these targets. A more effective penetrator capability such as that claimed by the inventor of "Deep Digger" is required.

This effort is responsive to Special Operations Forces interests as well as the consolidated Mission Need Statement of the U.S. Air Force Combat Command and the U.S. Strategic Command. The deep digger system would be delivered by a guided munition airframe such as used by the Air Force and the Navy. As an integrated weapon, this concept has application as a breaching tool.

FY 1997 Accomplishments

Technology Development (\$2,000K)

Developed a detailed description of the digger concept.

Developed a risk reduction experimental plan.

Supported expert panel review with in-depth analysis and experiments.

Produced a concept development plan for a follow-on action.

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Project AR - Johnston Atoll Remediation - The Agency is currently managing the environmental restoration of a 24-acre site on Johnston Atoll which is contaminated with plutonium from atmospheric nuclear weapon missile aborts in 1962. The technology developed and used over the years is demonstrably successful; in two more years the volume of contaminated soil (dredged, filled, and compacted coral) will be reduced from 180,000 metric tons to 29,000 metric tons. That technology is reaching the limits of its effectiveness, and an additional process, yet to be identified, is necessary to further reduce the volume. The clean portion of the soil is available for use on Johnston Atoll. DSWA plans to dispose of the waste at the Nevada Test Site. With removal of the waste from Johnston Atoll, the 24-acre site can be returned to unrestricted use. At a current cost of \$1.0 million per thousand metric tons of waste, the expense of shipping and disposing of the remaining low-level radioactive waste mandates that it be the smallest volume attainable.

To that end, the Agency has undertaken a program to identify and employ an innovative waste-reduction technology (or combination of technologies) to reduce the volume of waste to a manageable and less-expensive 5,000 metric tons. Through a series of vendor bench-scale and pilot-scale technology demonstrations with the support of the Department of Energy facilities at the Nevada Test Site, the Agency hopes to identify or develop an effective technology that can be scaled up to meet the unique conditions at Johnston Atoll.

FY 1997 Accomplishments

Technology Development (\$2,000K)

Successfully completed two bench-scale technology demonstrations at the Nevada Test Site; follow on pilot scale technology demonstration to be conducted during FY 1998.

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Project AY - Bioenvironmental Hazards Research - This is a Congressionally mandated project that provides for research on bioenvironmental hazards of specific DoD concern. Areas of research include human health effects and risk evaluation, pollution preventions, waste stream treatment, remediation, and impact assessment of atmospheric emissions. Funds were provided as a Congressional addition in FY 1994, FY 1995, FY 1997 and FY 1998 and were intended to continue efforts begun by a grant in FY 1989 to Tulane and Xavier Universities. Additional funding was made available from existing Agency resources to comply with Congressional direction to continue this effort through FY 1996.

FY 1997 Accomplishment (\$5,000K)

Awarded 12 Bioenvironmental Research grants. Areas of research include study of specific effects of environmental contaminants, remediation of NBC wastes reduction and remediation, risk assessments of JP-8 fuel, and others.

FY 1998 Plans (\$5,000K)

Award research grants to study and understand mechanisms involving synergism between contaminants and their effect on the human and ecological systems.

Review final draft of research conducted with FY 1993 funds and publish report in late FY 1998.

Collect and analyze information and data on current remediation efforts, such as bioremediation, to ensure their effectiveness.

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B. Program Change Summary

	<u>FY97</u>	<u>FY98</u>	<u>FY99</u>
Previous President's Budget	192.3	212.0	221.7
Current Budget Submit/President's Budget	189.2	203.7	0.0

Change Summary Explanation:

In accordance with the November 1997 Defense Reform Initiative, resources for FY 1999 and out which were previously addressed in this PE have been transferred to PE 0602715BR (WMD Related Technologies).

C. Other Program Funding Summary:

	<u>FY 97</u>	<u>FY 98</u>	<u>FY 99</u>	<u>FY 00</u>	<u>FY 01</u>	<u>FY 02</u>	<u>FY 03</u>
0602715BR WMD Related Technologies	0.0	0.0	203.6	206.6	209.7	212.7	215.9

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Advanced Technology Development - BA3					R-1 ITEM NOMENCLATURE Verification Technology Demonstration; 0603711H					
COST (In Millions)	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Cost to Complete		
Total 0603711BR Cost	25.3	80.8	0.0	0.0	0.0	0.0	0.0	Continuing		
Project CA Strategic Arms Control Technology	8.2	7.8	0.0	0.0	0.0	0.0	0.0	Continuing		
Project CB Conventional Arms Control Technology	9.9	9.0	0.0	0.0	0.0	0.0	0.0	Continuing		
Project CC Chemical Weapons Convention	7.2	9.1	0.0	0.0	0.0	0.0	0.0	Continuing		
Project CD Nuclear Arms Control Technology	0.0	54.9	0.0	0.0	0.0	0.0	0.0	Continuing		

**A. Mission Description and Budget Item Justification** - This program element covers implementation, compliance, monitoring and inspection, research development test and evaluation (RDT&E) for existing and emerging arms control treaties and agreements. The funded projects conform to requirements presented and approved by the Office of the Under Secretary of Defense (Acquisition & Technology) through the DoD Arms Control Requirements Assessment Board (RAB) process. RDT&E fulfills the technical requirements to implement, comply with, and monitor the following treaties/agreements: the Treaty on the Reduction and Limitation of Strategic Offensive Arms (START); the Treaty on Further Reduction and Limitation of Strategic Offensive Arms (START II) (START III); the Anti-Ballistic Missile (ABM) Treaty; the Intermediate-Range Nuclear Forces (INF) Treaty; the Conventional Armed Forces in Europe (CFE) Treaty; the Open Skies (OS) Treaty; the Convention on Certain Conventional Weapons (CCW); the Chemical Weapons Convention (CWC); Comprehensive Test Ban Treaty (CTBT); the CFE Adaptation negotiations; the Anti-Personnel landmine negotiation; Presidential arms control initiatives; and other existing and emerging arms control related agreements, treaties, and initiatives, such as the United Nations (UN) Transparency in Armaments; the Organization on Security and Cooperation in Europe's Vienna Document 94 (VD-94) and the Global Exchange of Military Information (GEMI); Missile Technology Control

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Mission Description and Budget Item Justification (cont'd) - Regime (MTCR) and the UN's Transparency in Armaments Agreement. It also provides confidence and transparency building capabilities to support DoD efforts concerning the Biological Weapons Convention (BWC), and conforms to the Administration's research and development priorities as related to both conventional arms control and weapons of mass destruction arms control, and disarmament. Arms control technologies are critical for enabling the U.S. to monitor, verify and implement international arms control treaties and other agreements whose purpose is to prevent the proliferation and or reduction of nuclear, chemical, biological, and other advanced conventional weapons. Technical assessments are made to provide the basis for sound project development, to evaluate existing programs, and to provide the data required to make compliance judgments. Technology developments and system improvement projects are conducted to ensure that capabilities to monitor, comply with, and implement treaties and agreements are available when required.

The program includes development of equipment and procedures for data exchanges, on-site and aerial inspections and monitoring, and other confidence-building measures. In addition, assistance is provided to the Office of the Secretary of Defense by providing technical support in preparing for U.S. compliance with treaty obligations. For example, work includes an assessment to determine the susceptibility of a CTBT verification regime to evasive measures. Results will be used by the CTBT negotiators to develop a technically robust International Monitoring System (IMS). Hardware and procedures developed are often transitioned to the On-Site Inspection Agency (OSIA), or appropriate international inspectorate, as in the case of the CWC, for use in conducting treaty mandated inspection and monitoring and for implementing transparency and confidence-building regimes. Where applicable, RDT&E to meet requirements in one treaty area is applied to fulfill requirements in other areas to eliminate duplication of efforts. For example, development of remote monitoring capabilities for future START Treaty applications will also be evaluated for use to verify limits and activities in a future conventional arms control regime. The technologies and procedures developed in the arms control technology program provided an invaluable source of information on equipment and procedures that was extensively used by an Agency team to support an interagency assessment of Long Term Monitoring of Iraq. The results of the effort and equipment developed in this program are being used to implement the provisions of United Nations Resolution 715.

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Mission Description and Budget Item Justification (cont'd) - The Agency's synergistic approach to fulfilling arms control requirements has been maximized in data management development. Arms control treaties require extensive exchanges of data concerning treaty accountable items, initial declarations, movements, etc., by signatory nations. The Agency has developed a treaty information management system, the Compliance Monitoring and Tracking System (CMTS), to accommodate these data exchanges and monitor U.S. compliance with treaty data reporting provisions. The CMTS provides treaty required data exchanges for INF, START, CFE and Confidence- and Security-Building Measures. A DoD system, Chemical Accountability Management Information Network (CAMIN), is under development to create the capability to transmit CWC required data. The Open Skies Notification System (OSNS) is being developed to support an anticipated FY1998 treaty entry-into-force (EIF). Operational control of the CMTS was transitioned to OSIA in a phased approach starting with Data Management/Notification System (DMNS) and START Central Data System (SCDS) in FY1997. The Chemical Weapons Convention Information Management System (CWCIMS) was offered to the Preparatory Commission at the Hague by the United States Government (USG). The Commission accepted the U.S. offer and the system was delivered in late FY1996.

Beginning in FY 1998, the architecture for presentation/execution of this program has been changed. Elimination and realignment of the Implementation and Compliance (I&C) category resulted in all negotiation, compliance, and implementation efforts moving to the Technical Assessments category. All hardware and software developments in I&C have moved to the Technology Development or Improvements category to reflect the actual nature of the effort.

The November 1997 Defense Reform Initiative (DRI) directed the establishment a Defense Threat Reduction and Treaty Compliance Agency effective 1 October 1998. As a result of the DRI, resources for FY 1999 and out which were previously addressed in this Program Element (PE) have been transferred to PE 0603711BR.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Advanced Technology Development - BA3	R-1 ITEM NOMENCLATURE Verification Technology Demonstration; 0603711H	

Project CA - Strategic Arms Control Technology - This project consists of research, development, test and evaluation (RDT&E) activities required to provide the capabilities needed to conduct monitoring, inspections, and data exchanges under the Strategic Arms Reduction Treaty (START), START II, START III, Missile Technology Control Regime (MTCR), Safeguards, Transparency and Irreversibility (STI) Agreement, Anti-Ballistic Missile (ABM) Treaty, and the Intermediate-Range Nuclear Forces (INF) Treaty. It also assists the United States Government (USG) and industry in compliance with the treaties and development of technology to meet requirements of future strategic arms control agreements. The projects conform to requirements presented and approved by the Office of the Under Secretary of Defense (Acquisition & Technology), (OUSD(A&T)), through the DoD Arms Control Requirements Assessment Board (RAB) process and OSD/Arms Control Implementation and Compliance memorandum of 31 July 1997, subject: Guidance, Mission Needs and Requirements Summary.

The START Central Data System (SCDS), as part of the Compliance Monitoring and Tracking System (CMTS), enables the U.S. to generate treaty-required notifications, perform treaty compliance assessments, and transmit notifications to treaty states for START. The START II Treaty, signed in January 1993, requires inspections of converted SS-18 silos and authorizes additional re-entry vehicle on-site inspections of Intercontinental Ballistic Missiles (ICBMs) installed in the converted silos. It also introduces new rules for counting strategic forces that complicate START reporting. Tools developed by this program will enable the USG to effectively exercise treaty inspection rights and monitor compliance and reporting. Technology development efforts are planned to support anticipated future treaty requirements in the most non-intrusive and cost-effective manner. Future strategic arms control regimes may consider non-deployed missiles and warheads in all phases, to include conversion and/or elimination, and would require the development of new procedures and equipment to accomplish the monitoring task. The primary focus of the efforts is on more effective methods of measuring characteristic Treaty Limited Item (TLI) signatures with technologies such as object and pattern recognition and micro-machined integrated neutron detector and providing monitoring/inspection capabilities to ultimately reduce cost and increase the flexibility of U.S. inspectors.

Overall RDT&E requirements and implementation timelines are dependent on the desired robustness and implementation schedule for the various components of the verification regime. RDT&E is being initiated now to ensure that monitoring and

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Project CA - Strategic Arms Control Technology (cont'd) - inspection systems are available at treaty entry into force (EIF) and that negotiators have the technical information to make informed decisions on key issues. This project supports the JCS Warfighting Capability of counterproliferation.

## FY 1997 Accomplishments

### Implementation and Compliance (\$5.0M)

- Completed transition of CMTS SCDS system to the On-Site Inspection Agency (OSIA).
- Initiated implementation of future START/START II treaties data and information exchange revisions into CMTS.
- Completed requirements for START II data base.
- Provided treaty compliance assessments and planning support to OUSD(A&T)/ACI&C.
- Provided technical and engineering support to START Treaty commissions (JCIC/BIC).
- Delivered CMTS.

### Technical Assessments (\$5.5M)

- Completed strategic weapons and materials monitoring assessment to support post-START II requirements to monitor mobile delivery systems, non-deployed nuclear weapons and delivery systems, and warhead inventories.
- Completed assessment of existing analytical tools for applicability to ABM/Theater Missile Defense (TMD) demarcation.

### Technology Development (\$2.7M)

- Conducted and completed prototype gravity gradiometer system field trials and technical data package.
- Conducted and completed gravity gradiometer modeling and simulation data verification analysis.
- Completed Corral Monitoring System (CMS) prototype and system documentation.
- Initiated system concept, design concept, and prototype technology development for detection, identification, and tracking of ABM treaty related TLI's.
- Initiated new approaches for Wide Area Tracking System (WATS) to detect nuclear weapons and dispersal devices transported on land.

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## Project CA - Strategic Arms Control Technology (cont'd) -

### FY 1998 Plans

#### Technical Assessments (\$3.3M)

- Provide treaty compliance assessments and planning support to OUSD(A&T)/ACI&C.
- Provide technical and engineering support to START Treaty commissions (JCIC/BIC).
- Continue research on technologies to support post-START II requirements to monitor mobile delivery systems, non-deployed nuclear weapons and delivery systems, and warhead inventories.
- Determine the potential utility of tagging as a monitoring aid in future strategic arms control regimes.
- Explore "offense/defense" systems differentiation issues and potential future force structure effects posed by START III/IV negotiations.
- Review/assess adjunct monitoring concepts and technologies which could enhance inspector performance in the implementation of current treaties.
- Assess requirements for Arms Control Implementation and Compliance Information System and analytical tools as a basis for future arms control automated systems.

#### Technology Development (\$4.5M)

- Incorporate START II software modifications to support CMTS interface with international data exchange formatting.
- Complete Object Pattern Recognition prototype development.
- Continue Emerging Technologies investigations for future treaty requirements through industry, academia and national laboratories.
- Complete CMTS SCDS documentation and deliver source code.
- Select promising warhead accountability technologies for vulnerability analysis and further development.
- Begin design and development of ABM/TMD computer analysis models.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Advanced Technology Development - BA3	R-1 ITEM NOMENCLATURE Verification Technology Demonstration; 0603711H

CB - Conventional Arms Control Technology - This project covers research, development, test & evaluation (RDT&E) required to meet on-site and aerial monitoring, transparency, confidence-building, and peacekeeping monitoring technology requirements for existing, emerging, and potential treaties, agreements, and initiatives related to Conventional Arms Control (CAC) and compliance monitoring of peacekeeping regimes; ensure compliance; implement agreements; and provide technical support to negotiations. The funded projects conform to requirements presented and approved by the Office of the Under Secretary of Defense (Acquisition & Technology) through the DoD Arms Control Requirements Assessment Board (RAB) process and described in the Office of the Secretary of Defense (OSD)/Arms Control Implementation and Compliance (ACI&C) Memorandum, dated 31 July 1997, Subject: Guidance, Mission Needs and Summary Requirements. Relevant agreements which require continuing RDT&E support include: (1) the Conventional Armed Forces in Europe (CFE) Treaty, (2) Open Skies (OS) Treaty (projected Entry-Into-Force FY1997); (3) the Organization for Security and Cooperation in Europe (OSCE) Confidence- and Security-Building Measures (CSBMs) contained in Vienna Document 94 (VD-94) to include the Global Exchange of Military Information (GEMI) signed in December 1994 and the OSCE agreements contained in the Lisbon Document of 5 December 1996; (4) the United Nation's Transparency in Armaments (TIA) Agreement established in 1993; and the April 1996 Wassenaar Arrangement on Export Controls for Conventional Arms and Dual Use Goods and Technologies. The RDT&E needs for emerging treaty and agreement areas include: (1) the OSCE Review Conferences, with its OSCE Forum for Security Cooperation (2) the CFE Review Conferences and CFE Adaptation negotiations; (3) regional/sub-regional arms control and peacekeeping to include RDT&E arms control implementation support for the Dayton Agreement and conventional arms proliferation issues; (4) enhancing CSBMs, and (5) the Convention on Certain Conventional Weapons (CCW) and the Anti-Personnel Landmine (APL) negotiations in the Conference on Disarmament and the Ottawa Process. This project also supports U.S. implementation of and compliance with the decisions of consultative commissions, arms control negotiating and coordinating organizations including: the CFE's Joint Consultative Group; the OSCE's Forum for Security Cooperation; NATO's Verification Coordinating Committee and the High Level Task Force; the Conference on Disarmament; the Multilateral Working Group on Arms Control and Regional Security; the Wassenaar Arrangement; and the Open Skies Consultative Commission. Decisions in negotiating fora and by coordinating organizations listed above have resulted and will continue to result in new or revised

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CB - Conventional Arms Control Technology (cont'd) - implementation and compliance requirements to which the U.S. must abide. Further, they require technical advice and assessments to support U.S. positions and evaluate proposals to ensure DoD equities are protected. New treaty areas not previously addressed include the APL and expanded regional security and peacekeeping monitoring applications. This project supports the JCS Warfighting Capability of counterproliferation.

## FY 1997 Accomplishments

### Implementation and Compliance (\$8.0M)

Continued delivery of all baseline Open Skies Management and Planning System (OSMAPS) capabilities; ensured the system complies with all changes to the Open Skies regime and initiated planned modifications.

Continued baseline OSMAPS independent validation and verification.

Provided treaty compliance assessments and planning support to OUSD(A&T)/ACI&C.

Continued support of delivered prototypes, e.g., Synthetic Aperture Radar Open Skies (SAROS), SAROS Processor (SARPRO), Transportable OPS (TOPS), Data Annotation Recording and Mapping System (DARMS) and Data Management and Reporting System (DMRS).

Provided technical support for SAROS data standardization and implementation of fixed site SAR processor.

Applied a standard digital format to the Open Skies Infra-Red Line Scanner and Video data.

Continued assessment of candidate replacement sensors for Open Skies and other aerial monitoring regimes.

Completed development of CFE Notification Front End System (NOFES) and integrated it into DMNS.

Initiated update of Compliance Monitoring and Tracking System (CMTS) to comply with decisions of the OSCE Forum for Security Cooperation and the CFE Review Conference.

Transitioned operational control of Data Management and Notification System (DMNS) to the On-Site Inspection Agency (OSIA).

Delivered CMTS Version 4.4.

Conducted concurrent testing of CMTS compliance updates.

Completed work on an international effort to define and develop an Open Skies Data Bank of information.

Completed and deployed updated CMTS Open Skies Notification System (OSNS) software to ensure full compliance with Open Skies NOFES formats and concepts.

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## CB - Conventional Arms Control Technology (cont'd) -

Continued analyses of new classes of sensors to support aerial observation regimes.

Completed an assessment of APL detection technology focusing on wide area detection.

Initiated assessment of requirements for Arms Control Implementation Compliance Information System and analytical tools as a basis for future automated systems.

Initiated development of interaction arms control and CSBM training tool.

### Technical Assessments (\$1.2M)

Provided technical support (to include quick turn around and longer term analyses) to the U.S. delegations to the OSCC, the Joint Consultative Group, the CFE Adaptation negotiation, the Forum for Security Cooperation, the APL negotiation, and regional arms control negotiations and prepared to support the FY1998 OSCE Review Conference.

Tested and evaluated a micropower impulse radar for applicability to the implementation of the future or follow-on APL agreement.

Conducted assessments of technologies to support on-going or emerging conventional arms control negotiations (e.g., CCW-APL and CFE Adaptation negotiations).

Initiated technical assessments of regional arms control needs for Central and South America.

### Technology Development (\$.7M)

Identified technologies and prototypes, including the required replacement of the current U.S. OS Infra-Red Line Scanner to ensure U.S. compliance with emerging or evolving arms control requirements.

## FY 1998 Plans

### Technical Assessments (\$4.6M)

Provide technical support (to include quick turn around and longer term analyses) to the U.S. delegations to the OSCC, the Joint Consultative Group and CFE Adaptation, the Forum for Security Cooperation, the APL negotiation, and regional arms control negotiations.

Provide treaty compliance assessments and planning support to OUSD(A&T)/ACI&C.

Conduct assessments of technologies to support on-going or emerging conventional arms control negotiations and peacekeeping requirements for monitoring and complete assessment of APL agreements needs.

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## CB - Conventional Arms Control Technology (cont'd) -

Conduct technical assessment of regional arms control needs for the Pacific Rim.  
 Continue analysis of new classes of sensors for modification of the Open Skies regime and other aerial observation regimes.  
 Document and maintain prototypes to support current and future conventional arms control agreements.

### Technology Development (\$4.5M)

Continue development of a standard digital format for Open Skies digital sensors data.  
 Complete planned OSMAPS baseline updates, modifications and independent validation and verification of software.  
 Complete standardization of Infra-Red Line Scanner and Video data formats.  
 Continue to develop technologies and prototypes to meet U.S. implementation and compliance requirements.  
 Conduct concurrent independent validation and verification of the development of CMTS software.  
 Complete documentation of CMTS and deliver source code.  
 Complete development of interactive arms control and CSBM training tool.  
 Continue emerging technologies investigations for future treaty requirements through industry, academia and national laboratories.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Advanced Technology Development - BA3	R-1 ITEM NOMENCLATURE Verification Technology Demonstration; 0603711H	

Project CC - Chemical/Biological Arms Control Technology - This project funds research, development, test and evaluation (RDT&E) necessary to meet DoD requirements for the implementation of chemical and biological arms control agreements and technical analyses to support and protect DoD equities in the negotiation and review of arms control agreements. The DoD requirements are documented in OUSD(A&T)/ATSD(NCB) "Program Guidance, Mission Needs and Requirements Summary", dated 6 February 1997. The primary focus in this project has been and continues to be preparing for multinational verification of, and U.S. compliance with, the Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on their Destruction (CWC). This project develops and validates technologies to ensure that on-site sampling and analysis is effective and that DoD equities are protected during the course of all CWC inspections. The focus is on sample screening, sample preparation and analytical equipment and procedures which are accurate without revealing sensitive DoD information. Technologies developed to support the CWC synergistically support both the U.S.-Russian chemical weapons Bilateral Destruction Agreement and international peacekeeping efforts such as the UN Special Commission on Iraq. In the area of biological weapons arms control, this project provides for technical assessments to assist DoD and U.S. policy makers and negotiators in their efforts to strengthen the Biological Weapons Convention (BWC). These assessments are essential to DoD and U.S. negotiators in the multilateral arena, both in preparation for and subsequent to the BWC Review Conferences (RevCons) held every five years. The RevCons (latest RevCon held December 1996) have the goal of developing measures to strengthen compliance with the BWC; this project supports U.S. policy makers by analyzing and prioritizing proposed confidence-building measures. RDT&E following the RevCons will be essential in continuing this process and ensuring confidence-building is balanced against the need to protect legitimate DoD/U.S. equities. The project also provides technical assessments of transparency measures that are being reviewed for inclusion in a series of planned exchange visits among the US/UK/Russia, in accordance with the 1992 Trilateral Statement; the goal is to resolve ambiguities in compliance with the BWC as well as to promote openness on legitimate military BW defense programs.

This project descriptive plan supports the JCS Joint Warfighting Capability of counterproliferation.

FY 1997 Accomplishments

Implementation and Compliance (\$4.6M)

Developed next generation of analytical methods.

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## Project CC - Chemical/Biological Arms Control Technology (cont'd) -

Provided technical support for Office of the Secretary of Defense (OSD) Host Teams for Organization for the Prohibition of

Chemical Weapons (OPCW) inspections.

Supported OSD negotiations in BWC related issues.

Completed validation of Full Operational Capability (FOC) for Chemical Accountability Management Information Network (CAMIN) and conducted independent testing.

Conducted test and evaluation of new commercial-off-the-shelf (COTS) equipment for potential inclusion in the modular lab. Provided training on CAMIN.

Supported CWC inspection equipment/procedures test & evaluation.

Continued development of on-site sampling and analytical methods.

Continued technical support to OSD (Policy) to establish the U.S. position on and responses to issues raised concerning verification/implementation provisions of the CWC.

Conducted protocol/vulnerability assessment of DoD equities for BWC RevCon proposals for improved compliance.

Provided technical support to activities preparing for the 1996 BWC RevCon.

Updated and maintained Biological Weapons (BW) history database.

Continued technical support to OSD (Policy) on issues related to the Joint Statement of US/UK/Russia on BW.

### Technical Assessments (\$1.2M)

Continued validation of on-site sampling and analytical methods developed in DSWA programs.

Validated next generation of analytical methods.

### Improvements (\$.1M)

Developed improved decision algorithm for the Acoustic Resonance Spectrometer (ARS) system to provide greater confidence in identification of unknown chemical munitions.

Developed Quality Assurance/Quality Control protocols for analytical data software.

Completed commercialization of ARS.

Supported application of quality assurance/quality control protocols to CWC software.

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## Project CC - Chemical/Biological Arms Control Technology (cont'd) - Technology Development (\$1.3M)

- Initiated a comprehensive program for filling CWC-identified on-site inspection technology gaps.
- Continued to adapt more advanced spectroscopy technologies that can be used in instruments during on-site sampling and analysis.
- Initiated commercialization of Swepts Frequency Acoustic Interferometry (SFAI).
- Adapted innovative sensing technologies for potential CWC verification applications.
- Initiated commercialization of SFAI.
- Initiated engineering development of the hand-held gas chromatography chemical detector.
- Initiated project to integrate sampling and analysis components into an on-site laboratory system.

## FY 1998 Plans

### Technical Assessments (\$2.7M)

- Continue development and evaluation of on-site sampling and analytical methods.
- Continue technical support to CWC Policy Interagency Working Group to establish the U.S. position on and responses to issues raised concerning verification/implementation provisions of the CWC.
- Conduct assessments of commercial-off-the-shelf (COTS) equipment for potential use in the On-Site Lab.
- Continue protocol vulnerability assessments of DoD equities for BWC AD HOC Committee proposals for improved compliance.
- Provide technical support to BW Trilateral Statement Negotiations and Visits.
- Provide technical assessments in preparation for BWC National Trial and Trilateral Exchange Visits.
- Conduct technical lessons learned assessments following BWC National Trial and Trilateral Exchange Visits.
- Expand and maintain BW History and Database.
- Assess requirements for Arms Control Implementation Compliance Information System and analytical tools as a basis for future automated systems.

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## Project CC - Chemical/Biological Arms Control Technology (cont'd) - Technology Development (\$6.4M)

- Conduct technical peer review process of analytical methods and other papers and issues pertaining to sampling and analysis.
- Evaluate emerging sampling, sample preparation, and analytical technologies to meet CWC-identified technology gaps.
- Continue to adapt more advanced spectroscopy technologies to improve on-site sampling and analysis.
- Continue engineering development of the hand-held chemical detector.
- Support CWC inspection equipment/procedures test & evaluation.
- Continue developing analytical data software for CWC-specific equipment.
- Initiate Phase II Analytical Software development.
- Support commercialization and provide improved sensitivities to flow injection trace gas analyzer for lewisite monitoring.
- Support commercialization and provide improved algorithms in the SFAL.
- Continue emergency technology investigations for future treaty requirements through academia, industry and national laboratories.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Advanced Technology Development - BA3	R-1 ITEM NOMENCLATURE Verification Technology Demonstration; 0603711H	

Project CD - Nuclear Arms Control Technology - This project consists of research, development, test and evaluation (RDT&E) activities required to provide a comprehensive and integrated DoD research and development program to support preparation, implementation, compliance, and verification of the CTBT. This project is consistent with the direction given December 1995 by the Deputy Secretary of Defense (Implementation of the Comprehensive Test Ban Treaty), May 1996 by the Under Secretary of Defense for Acquisition and Technology (Revised Arms Control Treaties and Agreements Planning Assumptions) and the August 1996 Program Decision Memorandum 1 that describes funding for CTBT safeguards support and funding required for CTBT entry-into-force.

The CTBT arms control activities are the following:

U.S. CTBT International Monitoring System (IMS) Sensors-- The Treaty will require the U.S. to contribute 40 stations to the IMS . This funding supports R&D, implementation, operations, and maintenance for the 24 stations not covered under funding from other sources.

CTBT International Data Center (IDC)-- In the CTBT negotiations, the U.S. committed to develop, prototype and transition to the CTBT international organization an International Data Center which would have the capability to acquire, archive, process and analyze data from approximately 320 sensor stations positioned around the globe, and to disseminate raw data and products to all States Parties. The IDC will serve as the central data processing hub for the Treaty verification regime, and will be located in Vienna, Austria, at the headquarters of the CTBT international organization. The IDC will be critical for supporting U.S. objectives for CTBT compliance and global monitoring.

U.S. CTBT Interface-- The U.S. must develop, integrate, test, evaluate, operate and maintain an interface to the international CTBT organization to support routing of data between U.S. facilities and the IDC; to support the U.S. National Authority in the execution of Treaty-related exchanges and decisions; and to function as a backup data archive, and research analysis center. This funding supports initial prototyping of the interface.

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Project CD - Nuclear Arms Control Technology (cont'd) -

Monitoring Safeguards RDT&E-- The U.S. agreement to a zero-yield CTBT is contingent upon the capability to independently monitor nuclear activities worldwide. Understanding, processing and analyzing monitoring data and providing actionable information based on these data and products will require significant basic research and exploratory development in the areas of seismic, hydroacoustic, infrasound, and radionuclide monitoring. This RDT&E work has no parallel in other arms control treaties; this Treaty requires an understanding of geophysical and physical phenomena that have not yet been studied or understood for any other purpose. The objectives of the R&D program are to enhance monitoring capabilities to meet current CTBT standards at decreasing cost over time.

Implementation/Compliance Support-- Measures are identified within the Treaty language to minimize the number of frivolous OSI requests and to maximize the early resolution of events of concern. A regular procedure for reporting large conventional explosions so that the signals detected do not raise suspicions will greatly reduce the number of OSI requests, and consequently the cost of participating in the Treaty. When events occur which cannot be resolved through confidence-building measures or consultation and clarification, U.S. decisionmakers must have the ability to react appropriately and in a timely fashion for both offensive situations (where the U.S. suspects a Treaty violation), and defensive situations (where the U.S. is challenged by another State Party over an ambiguous event). This funding supports initial prototyping of the decision systems and databases needed to address these issues.

FY 1998 Plans

U.S. CTBT IMS Sensors (\$9.1M)

- Replace Wake Island hydroacoustic station.
- Procure and install infrasound stations.
- Install aerosol samplers at four radionuclide stations.
- Install required seismic stations and provide needed upgrades to existing seismic stations.

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## Project CD - Nuclear Arms Control Technology (cont'd) -

### CTBT IDC (\$32.5M)

Integrate proven seismic, hydroacoustic, infrasound, and radionuclide data exploitation techniques into the automated and interactive systems.

Deliver limited IDC components to support initial operation and operational testing in Vienna.

Operate in parallel the interim and provisional IDCs.

Draft software manuals.

### U.S. CTBT Interface (\$3.8M)

Begin tests with PrepCom to demonstrate initial operating capability and to support data communication and backup data archive and analysis capability.

### Monitoring Safeguards RDT&E (\$6.0M)

Derive new methods for enhancing detection, location, screening and identification for seismic, oceanic and atmospheric events.  
Develop computerized, rapidly running techniques/algorithms to detect, locate, and identify optical signals from operational systems.

Develop improved understanding of source phenomenology and propagation for events near detection threshold.

### Implementation/Compliance Support (\$3.5M)

Develop the types of information to be presented to policy/decision makers.

Initiate database development for treaty-required information exchanges.

Conduct implementation and compliance assessments on selected CTBT issues.

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## B. Program Change Summary

Previous President's Budget

Current President's Budget

Change Summary Explanation:

FY1997      FY1998      FY1999

25.5      81.4      50.2

25.3      80.8      0.0

In accordance with the November 1997 Defense Reform Initiative, resources for FY 1999 and out which were previously addressed in this PE have been transferred to PE 0603711BR.

## C. Other Program Funding Summary.

0603711BR Verification Technology  
Demonstration

FY 97      FY 98      FY 99      FY 00      FY 01      FY 02      FY 03  
0.0      0.0      63.1      60.4      59.3      55.9      55.5

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